

On any occasion I should esteem it an honour to find that my researches received the sanction of Dr. Brown's prior claim; it is to avoid the charge of plagiarism from the 'princeps botanicorum,' or from M. Kunth, that I trouble you with this explanation*.

I am, Sir, yours obediently,

Bath, December 21, 1842.

JOHN WARREN HOWELL.

XIII.—*Observations on the Metamorphosis of an Annelide.*

By S. LOVÉN †.

[With a Plate.]

AMONGST the articulated animals the Annelides have without doubt been the least studied, notwithstanding the excellent researches which have recently been published by Milne-Edwards concerning them. Their development in particular is still almost quite unknown to us. The observation which I now present, although dismembered and imperfect, appears however to indicate, that, at least in the higher divisions of these animals, during their development, a metamorphosis takes place, which is almost as remarkable as that of insects.

Last August, as I was endeavouring to catch small marine animals with a fine draw-net, such as Entomostraca, &c., I at the same time unexpectedly obtained with these a great number of small lively creatures, which were so strange to me that I was unable to make out to what class they belonged. Fig. 1. (Plate I. B.) represents one magnified, in the form in which it first appeared after capture. The natural size amounted to about half a millimetre, and its structure seemed very simple. The most striking thing was a disc or oval ring (*a*), which bore upon its margin a row of vibrating cilia, and had a second smaller one over this; by the unceasing motion of these cilia the animal moved quickly to and fro, mostly progressing in an oblique direction.

On the side of this ring, which was usually directed upwards, the body rose towards the hinder part to a somewhat oblique hemisphere (*b*); the side generally opposed to it was also inflated (figs. 1, 2, 3, *c*), yet much less, and obliquely in front. On the upper side the mouth (*e*) appeared to be situated anteriorly near to the ring, the lips of which were provided with cilia. At the apex of this side was the anus (*h*), a small opening surrounded by a muscular ring. The whole was very transparent, and the course of the intestinal canal

* [It was by no means our intention to question the undoubted originality of Mr. Howell's valuable observations, but merely to direct the attention of our readers to what had been done by other botanists on the same subject.—Ed.]

† Translated from the German in Wiegmann's Archiv, Part 3, p. 302: 1842.

might be seen in the interior, which appeared still plainer when the little animal was fed with indigo. I then found that the intestinal canal was divided into two parts, the stomach (*f*), in the form of a sack, which extends posteriorly and somewhat downwards, and the intestine (*g*) which is separated from it by a contraction, and then growing still narrower ascends directly upwards to the anus. Almost in the middle of the lower raised surface of the animal was a minute spot (*i*), more opake, and placed diagonally, which in some individuals exhibited two small black points. From this structure it was easy to guess that the animal was not developed, but it was more difficult to say what it would change to.

This question was however soon solved. It was evident that the little animals, one after the other, underwent considerable changes. The upper elevated side (*b*) projected more and more, and divided into rings (fig. 2, *i*). The first of these formed themselves near to the anus (*h*), and their number increased by degrees, so that the last one added lay next to the disc. Each newly-formed ring consisted of four parts. Two of these semi-rings, the anterior and hinder, were large, and covered externally with muscular layers, and the other two shorter side-pieces united them. Whilst this change went on upon the disc, one quite as surprising took place below it. The above-mentioned spot constantly became more opake and distinct, and between the black points and in front of them were formed by degrees near the eyes (figs. 2, 3, 4), pointed filaments, which were the tentacula. The object of this uninterrupted metamorphosis now became apparent; it was evidently the development of an Annelide. The form now described and represented in fig. 2. very soon changed into that which is seen in fig. 5, whilst the number of the rings rapidly increased, and the former round, arched part (*b*) became the curled body of a worm. The disc, with its vibrating cilia, still existed, and the little animals, which had been two days captured, died one after the other. I was upon the point of renouncing the hope of pursuing their development to its end, when at last I found one which had survived longer, and which I have represented in fig. 6: this had no longer the ring provided with cilia round about the head (as fig. 5.), which was stretched freely forwards, and as a remnant of the ring, appeared on each side an appendage, without any decided form; the animal soon after died. On this account I cannot decide whether this appendage still remained fixed any time, or soon fell off; I had, however, reason to suppose the former. Several years ago I had already observed and sketched a small Annelide, which was swimming on the surface of the sea, resembling the one now described, but more

developed, and apparently belonging to another species. It is almost the same which Dr. Johnston has described and represented in the 'Annals of Natural History,' iii. p. 293. pl. vi. fig. 2, and which he supposed might be the young of Linnæus's *Nereis pelagica*. Both of these animals seen by him and by me bear upon each side of the head a kind of winged appendage richly provided on the under side with vibrating cilia; perhaps the tentacula are formed from these. This question remains unanswered, and also the formation of the feet.

Had I been able to pursue the development for a longer time, it would have become much less difficult to determine the species exactly; that cannot now be done, and an exact determination of the genus will be difficult to make. In the first place, however, it is clear, from the nature of the head, its eyes, and tentacula, that it is an animal of the class of the free Annelida, Lamarck's *Antennati*, and amongst these the form of the body appears to point to the family of the *Nereidæ* or *Euniceæ*. From the form of the head and the number of the eyes we might suppose it to be a *Phyllodoce*, and species of this genus are not rare upon our western coast [Sweden]; but without knowing the form of the foot, it is impossible to decide anything about it.

Short and imperfect as this observation must appear, it proves that at least certain Annelides undergo a kind of metamorphosis, which is no less remarkable than that of insects, and some Crustacea. Besides, it shows that the growth in the Annelides takes place in such a way that the new rings are added in front of, and not behind, the older ones, and that the last hindermost ring is the oldest; or, that the increase takes place furthest from the head, a law which has also been remarked with respect to the Entozoa. It appears also, that every ring originally consists of an upper and an under half-ring, a tergum and sternum, which are united by two side-pieces, from which proceed the feet at a later period.

DESCRIPTION OF THE PLATE.

PLATE I. B.

Fig. 1. Represents a young one, as it first appeared.

Fig. 2. The same, which has increased in size, and in which seven rings have been developed.

Fig. 3. The same, from the under side, in order to show the head with eyes and tentacula.

Fig. 4. The same, in profile from behind.

Fig. 5. The animal with a greater number of rings, and worm-shaped body.

Fig. 6. An individual after transformation of the ring.

In these figures, *a* represents the ring or disc; *b*, the upper or abdominal part; *c*, the under or head part; *d*, the head; *e*, the mouth; *f*, the stomach; *g*, the intestine; *h*, the anus; *i*, the ventral rings.